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Changes of Antimicrobial Resistance among Staphylococcus Aureus Isolated in 8 Consecutive Years in the First Bethune Hospital

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Abstract

This study was to investigate the antimicrobial resistance of Staphylococcus aureus isolated in 8 consecutive years in the First Bethune Hospital. Disk diffusion test was used to study the antimicrobial resistance. The data were analyzed by WHONET 5 software according to Clinical and Laboratory Standards Institute (CLSI). Most of 1469 strains of Staphylococcus aureus were collected from sputum 705 (18.0%), secretions 206 (14.0%), pus 177 (12.0%) during the past 8 years. The rates of methicillin-resistant *Staphylococcus aureus* (MRSA) were between 50.8% and 83.3% during the past 8 years, respectively. In recent 8 years, the antimicrobial resistance of Staphylococcus aureus had increased. Monitoring the antimicrobial resistance to *Staphylococcus aureus* should be strengthened. The change of the antimicrobial resistance should be investigated in order to direct rational drug usage in the clinic and prevent bacterial strain of drug resistance from being transmitted.

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Keywords: methicillin-resistant Staphylococcus aureus; drug resistance, microbial; antimicrobials susceptibility test; drug monitoring

1.Introduction

Methicillin-resistant *Staphylococcus aureus* (MRSA) poses a major threat to public health worldwide, due to the rapid spread and diversification of pandemic MRSA clones with increasing virulence and antimicrobial resistance[1]. In *Staphylococcus aureus*, antimicrobial resistance has been more frequently found among MRSA strains than among methicillin-sensitive *Staphylococcus aureus* (MSSA) strains, which may be related to the *mec*A-mediated resistance. The objectives of this study were to investigate

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the antimicrobial resistance of *Staphylococcus* aureus isolated in 8 consecutive years in the First Bethune Hospital.

2.Materials and methods

2.1.Bacterial isolates

Consecutive nonduplicate nosocomial isolates of *Staphylococcus aureus* were collected during the period from 2003 to 2010 in the First Bethune Hospital. Isolates were identified at the species level using standard biochemical tests and microbiological methods.

2.2.Antimicrobial susceptibility testing

The susceptibilities of *Staphylococcus aureus* to 19 antimicrobial agents were determined by the disk diffusion method in accordance with Clinical and Laboratory Standards Institute (CLSI) guidelines.

2.3.Detection of MRSA.

Detection of MRSA was according to CLSI. *Staphylococcus aureus* ATCC 25923 and *Staphylococcus aureus* ATCC 43300 strains served as quality controls.

3.Results

Distribution of specimen type: during the 8-year study period, 1469 consecutive clinical isolates of *Staphylococcus aureus* were isolated. The strains were cultured from sputum 705 (48.0%), secretions 206 (14.0%), pus 177 (12.0%), blood 100 (6.8%), urine 69 (4.7%), pleural fluid and abdominal fluid 62 (4.2%), bile 44 (3.0%), bone marrow 38 (2.6%), others 68 (4.6%)。

The rates of MRSA were 50.8% (31/61), 58.0% (40/69), 60% (48/80), 79.8% (*79*/99), 83.3% (100/120), 80.8% (295/365), 81.3% (260/320), 80.3.% (285/355) from 2003 to 2010, respectively.

Resistance of MRSA and MSSA is shown in table 1。

4.Discussion

The rapid emergence and spread of drug-resistant organisms, such as *Staphylococcus aureus*, both in the healthcare setting and the community prompts great urgency in the development of and advocacy for prevention and treatment efforts. *Staphylococcus aureus*, a gram-positive bacterium, is both a commensal organism found as part of the normal human flora in 30 percent of the population as well as a resourceful human pathogen able to cause severe and devastating illness[2]. The top three specimen types in the present study were sputum, secretions and pus in the past 8 years in the First Bethune Hospital. It is emphasized that *Staphylococcus aureus* are mainly responsible for pneumonia and wound infection in the First Bethune Hospital.

The current study showed prevalence of MRSA ranging from 50.8％ to 83.3％ in *Staphylococcus aureus* in the First Bethune Hospital was higher in Canada and America[3-4]. It is associated with different geography, breakpoints, or antimicrobial susceptibility testing. Clinical laboratories need to have adequate equipment and expertise to provide detection method for MRSA.

In addition to excellent activity of vancomycin and teicoplanin, the resistance rates of MRSA for clindamycin, rifampin, piperacillin/tazobactam, erythromycin, tetracycline, penicillin G, ampicilin, cefazolin, cefuroxime sodium, cefotaxime, cefepime, ciprofloxacin, levofloxacin, gatifloxacin were

almost more than 50% during 8 years in the First Bethune Hospital. However, antimicrobial resistance of MSSA to almost antibiotics except clindamycin, erythromycin, penicillin G, and ampicilin were no more than 40.0％。The resistance rates of MRSA to the most antibiotics are much higher than those of MSSA during 8 years in the First Bethune Hospital. Methicillin resistance is mediated via a chromosomally incorporated resistance gene, mecA, which confers altered binding of β -lactams to penicillin binding protein 2a. The mecA gene is packaged in a cassette called the staphylococcal cassette cartridge (SCC), which aids in successful chromosomal incorporation[5].

Monitoring antibiotic use with microbiology laboratory support can promote rational drug utilization, cut costs and delay the emergence of resistant organisms.

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TABLE 1 Antimicrobial resistance of *STAPHYLOCOCCUS AUREUS* (％)

ANT	2003 (n=61)		2004 (*n*=69)		2005 (*n*=80)		2006 (*n*=99)		2007 (*n*=120)		2008 (*n*=3650		2009 (*n*=360)		2010 (*n*=355)	
	MSSA (*n*=30)	MRSA (n=31)	MSSA (*n*=29)	MRSA (*n*=40)	MSSA (*n*=32)	MRSA (*n*=48)	MSSA (*n*=20)	MRSA (*n*=79)	MSSA (*n*=20)	MRSA (*n*=100)	MSSA (*n*=70)	MRSA (n=295)	MSSA (*n*=60)	MRSA (*n*=260)	MSSA (*n*=70)	MRSA (*n*=285)
VAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	1.4
FOX	—	—	—	—	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
OXA	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
SXT	23.3	32.3	20.7	30.0	21.9	29.2	20.0	21.5	15.0	20.0	14.3	20.3	15.0	20.8	14.3	20.0
CLI	33.3	71.0	37.9	72.5	40.6	90.9	50.0	86.1	50.0	92.0	52.9	93.2	56.7	92.3	52.9	93.0
RIF	10.0	32.3	10.3	35.0	12.5	33.3	10.0	88.6	15.0	87.0	12.9	83.1	13.3	80.8	14.3	87.7
TZP	6.7	71.0	6.9	72.5	9.8	83.3	15.0	89.9	15.0	93.0	18.6	91.5	18.3	92.3	20.0	94.7
ERY	60.0	87.1	62.1	87.5	62.5	90.0	75.0	91.1	75.0	92.0	78.6	94.9	81.7	96.5	81.4	93.3
TCY	30.0	67.7	31.0	77.5	31.3	87.5	30.0	91.1	40.0	93.0	38.6	94.9	38.3	95.4	40.0	94.7
PEN	66.7	100.0	69.0	100.0	83.3	100.0	90.0	100.0	90.0	100.0	92.9	100.0	93.3	100.0	95.0	100.0
AMP	66.7	100.0	69.0	100.0	83.3	100.0	90.0	100.0	90.0	100.0	92.9	100.0	93.3	100.0	95.0	100.0
CZO	0.0	87.1	0.0	80.0	0.0	87.5	0.0	92.3	5.0	94.0	1.4	93.2	3.3	95.4	4.3	94.7
CXM	3.3	90.3	3.4	87.5	6.3	93.8	5.0	93.7	5.0	95.0	5.7	96.9	8.3	95.8	8.6	95.4
CTX	3.3	87.1	6.9	80.0	9.4	89.6	10.0	93.7	10.0	96.0	18.6	96.9	18.3	97.3	20.0	97.5
FEP	3.3	87.1	6.9	77.5	9.4	87.5	10.0	96.2	10.0	94.0	17.1	94.6	18.3	95.8	18.6	97.2
CIP	6.7	80.6	6.9	87.5	12.5	91.7	15.0	98.7	15.0	98.0	25.7	98.3	23.3	98.1	24.3	98.2
LEV	6.7	71.0	6.9	77.5	9.4	91.7	10.0	94.9	10.0	94.0	18.6	96.6	16.7	96.2	18.6	97.2
GAT	3.3	32.3	3.4	40.0	6.3	49.0	5.0	59.5	5.0	66.0	11.4	70.2	10.0	71.2	10.0	77.2

Note: ANT: antibiotics, VAN: vancomycin, TEC: teicoplanin, FOX: cefoxitin, OXA: oxacillin, SXT: trimethoprim/sulfamethoxazole, CLI: clindamycin, RIF: rifampin, TZP: piperacillin/tazobactam, ERY: erythromycin, TCY: tetracycline, PEN: penicillin G, AMP: ampicilin, CZO: cefazolin, CXM: cefuroxime sodium, CTX: cefotaxime, FEP: cefepime, CIP: ciprofloxacin, LEV: levofloxacin, GAT: gatifloxacin, MSSA: methicillin-sensitive *Staphylococcus aureus*, MRSA: methicillin-resistant *Staphylococcus aureus*, —: no data